

# HP and Memjet Ink Jet Page-Wide-Array Devices

A Challenge to Laser  
Dominance in the Office?

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## Introduction

The development of page-wide-array ink jet devices has been a topic of discussion in the imaging industry since the mid-1990s. However, it wasn't until Silverbrook Technology demonstrated its Memjet devices in early 2007 and HP introduced its Edgeline devices—which used a page-wide implementation of its Scalable Printing Technology (SPT)—later that year that interest in the technology really heated up. Interest remained somewhat tepid as HP pulled Edgeline devices from the market and Memjet had difficulty in finding partners to adopt its technology. Memjet printers began to reach the market in 2011, through partners such as LG Electronics in Korea, Lomond in Europe, and Parts Now in North America, but development of the devices has been slow. Memjet is a relatively unknown company that is trying to sell a new technology that competes with laser printers, which have long been established as *the* office print technology. Then, in October 2012, HP announced its Officejet Pro X page-wide-array printer, which subsequently began shipping in February 2013.

This report analyzes the development of these new products and the potential of page-wide-array ink jet as a transformative technology in the office printing market, especially in small and medium-size businesses (SMBs) and particularly in small workgroups that have fewer than 10 employees. It looks at both the strengths and weaknesses of the new devices versus those of incumbent laser printers and discusses their potential for future growth as well as potential barriers to their entry into the office printing market.

## HP's Officejet Pro X

### The History of HP's Officejet Lineup and SPT

HP's Officejet Pro X series is the latest iteration of the company's business-class products that are based on its Scalable Printing Technology, which HP first introduced with its HP 2000C Professional Series color printers in 1998. This was the first ink jet printer that HP positioned as an alternative to laser printers. HP highlighted its high speed (8 ppm in black and 2 ppm in color in normal mode) and low unit price (\$799) and cost per page (1.9 cents for black and 14 cents for color) compared to those of color laser printers. Its off-axis print head was unique for HP desktop ink jet printers at the time. The design enabled HP to offer cartridges with high yields of approximately 2,200 pages, which was comparable to that of many laser printers on the market.

Although the 2000C certainly garnered interest as a technology, at \$799 it was still too expensive for an ink jet printer, especially since it was positioned against laser printers, and it was not a commercial success. The concept of business ink jet printers was just too radical for businesses that still viewed ink jet devices as consumer products that were perhaps adequate as personal devices used for occasional printing but clearly not as mainstream office products.

### HP's Officejet 8500 and 8600: The Turning Point

HP continued to introduce new iterations of its business ink jet printer line, improving performance and bringing down cost, but it was still unable to gain significant momentum for its products until the launch of the Officejet 8500 All-in-One. Several of the device's key features either met or exceeded those of competitive color laser printers:

- print speeds of 15 ppm in black and 11 ppm in color in normal mode;
- \$199 unit price; and
- low-cost supplies, with a cost per page of 1.8 cents per page in black and 6 cents per page in color (CMY), which are approximately half the black and color printing costs of competing laser devices.

HP also ran an intensive marketing campaign emphasizing that the device's print cost was 50 percent lower than that of color laser devices.

The price and speed of the Officejet 8500 were quite competitive with those of low-end color laser devices, but HP's message that the Officejet 8500's cost of printing was half that of laser devices resonated the most with buyers. This strategy of focusing on the cost of printing counterbalanced the usual concerns about the perceived print-quality ad-

vantage of laser devices, particularly for output printed on plain paper, which is more vibrant when it is printed from laser printers rather than ink jet devices. One other concern regarding ink jet technology is the potential for smudging, but this problem is minimal with pigment inks, which the Officejet Pro uses.

HP continued to develop a strong presence in the business ink jet market through the launch of the Officejet Pro 8600, which competes with Segment 1 A4 color multifunction printers (MFPs) that are designed for very small workgroups of one to three employees. **Figure 1** shows a comparison of the HP Officejet Pro 8500 and 8600 with Epson's WorkForce WF-3540 and WF-4530 and several Segment 1 A4 color laser MFPs. The speeds of both the ink jet and color laser models are comparable, at 15 to 19 ppm for black. The color speeds are a bit more diverse. The laser devices include both single-pass units, which generally have color speeds that are the same as monochrome speeds, and multi-pass units that require four passes to print all four colors, resulting in a print speed of about 4 ppm. The ink jet speeds range from 9 to 13 ppm. Print speeds for the business ink jet devices are roughly comparable to those of the laser machines.

**Figure 1: Business Ink Jet AIOs versus Segment 1 A4 Color Laser MFPs**

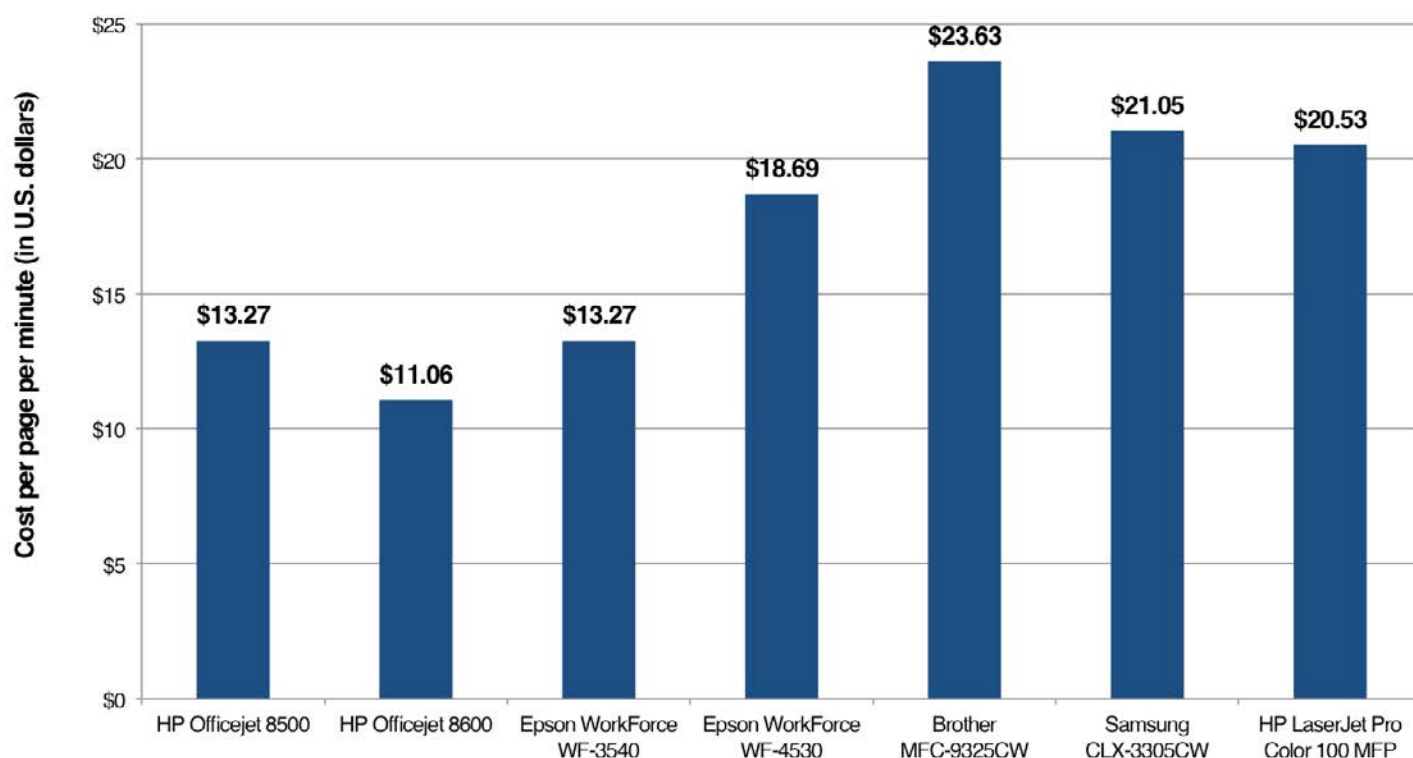
	HP Officejet 8500	HP Officejet 8600	Epson WorkForce WF-3540	Epson WorkForce WF-4530	Brother MFC-9325CW	Samsung CLX-3305CW	HP LaserJet Pro Color 100 MFP
ISO print speed (black/color)	15/11 ppm	18/13 ppm	15/9.3 ppm	16/11 ppm	19/19 pm	19/4 ppm	17/4 ppm
Unit price	\$199.00	\$199.00	\$199.00	\$299.00	\$449.00	\$399.99	\$349.00
Cost per page per minute of speed	\$13.27	\$11.06	\$13.27	\$18.69	\$23.63	\$21.05	\$20.53
Standard black cartridge price	\$26.98	\$26.99	\$18.99	\$38.49	\$74.99	\$54.99	\$49.99
Yield (pages)	1,000	1,000	385	2,400	2,200	1,500	1,200
Cost per page: black	2.7 cents	2.7 cents	3.4 cents	3.4 cents	3.4 cents	3.7 cents	4.2 cents
Yearly ink/toner cost of printing 500 pages per month	\$161.88	\$162.00	\$204.00	\$204.00	\$204.00	\$222.00	\$252.00
Standard color pages	\$20.99	\$19.99	\$17.09	\$24.49	\$69.99	\$54.99	\$56.99
Yield (pages)	900	700	470	1,200	1,400	1,000	1,200
Cost per page	7.0 cents	8.6 cents	10.9 cents	6.1 cents	15.0 cents	16.5 cents	14.2 cents
Yearly cost of printing 500 pages per month	\$419.80	\$514.03	\$654.51	\$367.35	\$899.87	\$989.82	\$854.85
Total cost (50/50 black/color pages)	\$290.84	\$338.01	\$429.26	\$285.68	\$551.94	\$605.91	\$553.43
Cost per page (50/50 black/ color pages)	4.8 cents	5.6 cents	7.2 cents	4.8 cents	9.2 cents	10.1 cents	9.2 cents
High-yield black cartridge price	\$38.99	\$36.99	\$29.99	N/A	N/A	N/A	N/A
Yield (pages)	2,200	2,300	945	N/A	N/A	N/A	N/A
Cost per page	1.8 cents	1.6 cents	4.2 cents	N/A	N/A	N/A	N/A
Yearly toner cost of printing 500 pages per month	\$212.67	\$192.99	\$192.99	\$0.00	\$0.00	\$0.00	\$0.00
High-yield color cartridges	\$27.99	\$27.99	\$20.39	N/A	N/A	N/A	N/A
Yield (pages)	1,400	1,500	755	N/A	N/A	N/A	N/A
Cost per page (CMY)	6.0 cents	5.6 cents	8.1 cents	N/A	N/A	N/A	N/A
Yearly cost of printing 500 pages per month	\$359.87	\$335.88	\$486.12	\$0.00	\$0.00	\$0.00	\$0.00
Total cost (50/50 black/color pages)	\$286.27	\$264.44	\$339.55	\$285.68	\$551.94	\$605.91	\$553.43
Cost per page (50/50 black/color pages)	4.8 cents	4.4 cents	5.7 cents	4.8 cents	9.2 cents	10.1 cents	9.2 cents

Source: Photizo Group and vendor websites

The ink jet all-in-one (AIO) devices have a distinct price advantage. Most of the devices are generally sold at about \$199 (although some products are priced a bit higher depending upon configuration), compared to \$349 to \$449 for Segment 1 color laser MFPs. Vendors also periodically lower prices to stimulate sales, but the prices listed in **Figure 1** are those found on the companies' websites in April 2013.

A simple analysis dividing the unit price by the black print speed shows that the ink jet models cost less per ppm than the laser models (see **Figure 2**). Costs for ink jet devices ranged from \$11.06 to \$18.69 per ppm, and those for the laser devices were \$20.53 to \$23.63. Although the ink jet models have a price/performance advantage, this may not be very meaningful to buyers, particularly those in small workgroup environments where page volumes may be limited.

**Figure 2: Cost per Page per Minute Comparison, Business Ink Jet AIOs versus Segment 1 A4 Color Laser MFPs, 2013**



Source: Photizo Group and vendor websites

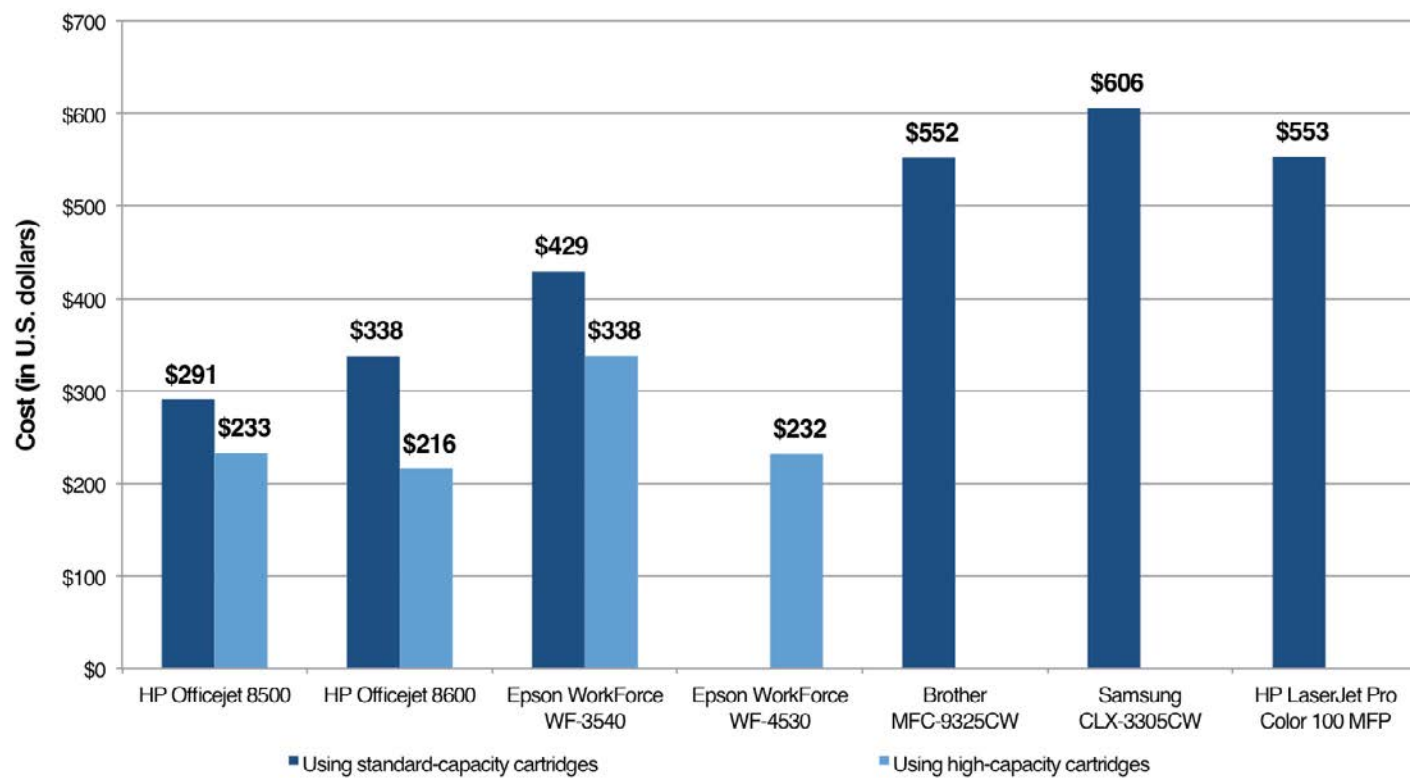
A more compelling discussion is the cost of printing, especially for businesses. Data gathered from printer vendors' websites regarding cartridge costs and yields for both standard and high-capacity ink and toner cartridges showed that ink jet printers have a clear advantage over laser devices. Black and color pages cost 1.6 to 3.4 cents and 5.6 to 8.4 cents, respectively, depending upon the printer model and whether a standard or high-yield cartridge is used with the device. The Segment 1 MFPs offered only standard-capacity cartridges with costs ranging from 3.4 to 4.2 cents for black and 14.2 to 15.6 cents for color.

Perhaps even more compelling are the differences in cost over a period of time. Assuming that the small workgroup users who employ these products print approximately 500 pages, or one ream of paper, per month, the total page volume for one year would amount to 6,000 pages. We also assume that these small workgroups would print 50 percent black and 50 percent color pages. **Figure 3** shows the cost of ink and toner required to print 6,000 pages in a year. The cost for laser MFPs is between \$552 and \$606, compared to \$291 to \$429 for ink jet devices using a standard cartridge and \$216 to \$338 for devices using high-capacity cartridges. These differences indicate that the cost of supplies gives the ink



jet devices a distinct advantage over comparable color laser devices. It should also be noted that the cartridge yields are based on the ISO standard, or normal office mode, rather than economy mode, which uses less ink and would provide higher yields and, therefore, lower costs. Also, not included in this calculation is the cost of the laser drums or other consumables that would add to overall printing costs but are replaced very infrequently.

**Figure 3: Ink or Toner Cost to Print 6,000 Pages,\* Business Ink Jet AIOs versus Segment 1 A4 Color Laser MFPs, 2013**



\*50 percent black and 50 percent color pages

Source: Photizo Group and vendor websites

HP was the first company to highlight the cost difference between ink jet and laser devices. The company ran a series of ads for its Officejet Pro 8500 that stated that the cost of printing from the device was 50 percent lower than that of a laser model. It was an interesting strategy, considering that HP held a major share of the laser printer market, although it was feeling some retail competition from Samsung and Brother at the time. HP aggressively fought off competition through its own laser printers, but low-end color laser models are not profitable given their relatively low print volumes, which creates a competitive advantage for business ink jet machines.

### Print Quality and Smudging: Old Perceptions Die Hard

Although ink jet printers' low cost of printing gives them a strong advantage over laser devices, it remains difficult for vendors to sell ink jet devices to office users. Low-end personal models are still very expensive to operate, primarily because they use cartridges with an expensive integrated print head that must be replaced once the ink is consumed. Most of the low-end devices use dye-based ink that is vibrant on specialty media but has a dull appearance on most office paper that is designed for copiers or laser printers.

Dye-based inks can also smudge when they are exposed to moisture, such as perspiration from a user's hand or ink from a highlighter pen. The early dye-based inks also faded rapidly, sometimes in as little as six months. Over time, dye-based inks improved significantly, but their reputation for fading still lingered, as did the other negative factors.

All of the factors mentioned above, coupled with low-capacity ink cartridges and a high cost of printing, made ink jet printers a poor choice for even moderate print requirements but especially for business use. Also, individual departments would sometimes purchase ink jet devices without the authorization of their company's IT department, which was then required to manage and resupply the machines. This further damaged the reputation of ink jet in the office. IT managers used managed print service providers to help remove desktop ink jet printers that departments purchased without IT authorization.

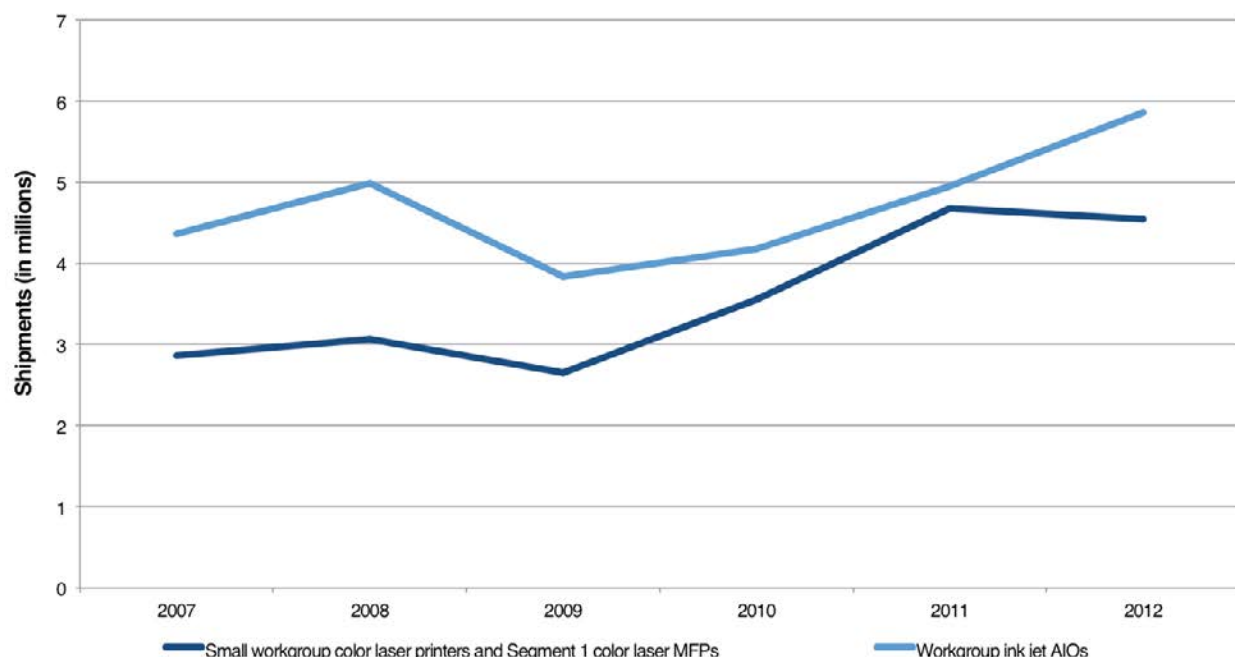
Business ink jet devices such as HP's Officejet Pro and Epson WorkForce models use pigment-based inks that dry fast, do not smudge, and have very high fade-resistance ratings of well over 100 years. The print quality from devices that use pigment-based inks may not be as vibrant as that of laser devices for plain paper or dye-based inks for coated media, but it has certainly improved as vendors continue to refine their inks. The actual differences may be minimal, but business ink jet devices are competing with laser devices that users still believe are faster, have better output quality, and are cheaper on a cost-per-page basis.

Among users in small workgroups of one to three employees, particularly in the small-office/home-office (SOHO) and SMB markets in which the printer owner, buyer, and user are often the same person, any differences in print quality may be overcome by ink jet's cost-per-page advantages. Saving \$200 per year can make those slight differences rapidly disappear.

#### Business Ink Jet All-in-One and Color Laser Printer and MFP Shipments

The past five years have been turbulent for the printer market in general. The great recession of 2008 and 2009 in particular had a significant impact on business purchases. As shown in **Figure 4**, workgroup ink jet AIOs (also known as business ink jet MFPs) and low-end color lasers, including both single-function devices that cost less than \$500 and Segment 1 MFPs, both experienced a significant decline in shipments in 2009. Shipments in the workgroup ink jet segment declined to 3.8 million in 2009, down from 5 million in 2008, and shipments of low-end color laser devices dropped to 2.7 million from 3.1 million in the same time period.

**Figure 4: Worldwide Workgroup Ink Jet AIO and Small Workgroup Color Laser Printer and Segment 1 Color Laser MFP Shipments, 2007-2012**



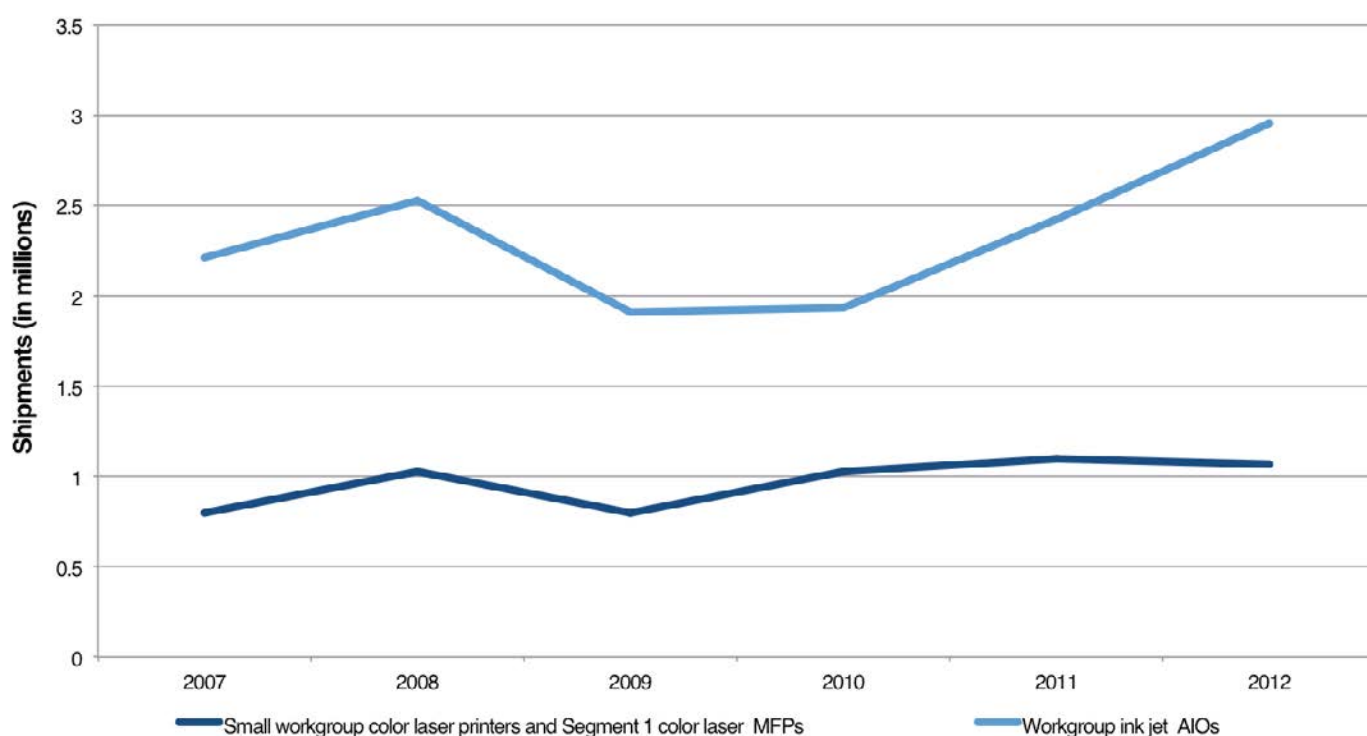
Source: Photizo Group, Hardware Advisory Service, December 2012



Unit shipments of both workgroup ink jet and low-end color laser devices rebounded starting in 2010 and 2011 at a much stronger rate than the printer market in general. In 2012, shipments of low-end color laser MFPs dipped slightly to 4.5 million, down from 4.7 million in 2011, but shipments of workgroup ink jet AIOs rose to nearly 5.9 million in 2012, up from 5 million in 2011.

The slowdown in shipments of color laser printers and MFPs could be a temporary condition. Previous drops in the market have been followed by rebounds, but there are indications that this time the shift may be permanent. **Figure 5** shows shipments in North America from 2007 through 2012. Shipments of low-end color laser printers and MFPs experienced a modest dip in 2009 to 798,000 units after reaching just above 1 million units in 2008. Shipments rose again to more than 1 million units in 2010 but remained quite flat through 2012. Workgroup ink jet AIO shipments dropped significantly in 2009 to just under 2 million units in 2009 and remained flat in 2010, but they grew to nearly 3 million units 2012.

**Figure 5: North American Workgroup Ink Jet AIO and Small Workgroup Color Laser Printer and Segment 1 Color Laser MFP Shipments, 2007-2012**



Source: Photizo Group, Hardware Advisory Service, December 2012

The North American market has the highest levels of color use in office environments. In general, businesses in this region historically have been early adopters of information technology, including printers, which employees were required to use in order to share any work that they produced on a PC. North America is also the region where any trends in color printing are generally first seen. Printer users in this region usually require high-quality output and are willing to pay more for color printing, albeit grudgingly. In contrast, users in most emerging markets are more cost-conscious and have been slow to adopt color printing for general office use. They prefer lower-cost monochrome printing for most applications and often use low-cost refilled toner and ink cartridges. Legibility is generally viewed as the quality standard.

However, even North American users are concerned about the high cost of color printing. In the past, color pages printed from low-end desktop laser or ink jet printers would often cost more than 20 cents each. In order for color printing to break through these barriers, prices had to come down significantly. HP's message that its new ink jet printers featured printing costs that were 50 percent lower than those of laser devices was an important stake in the ground.

As print speeds for both laser and ink jet devices reached comparable levels, ink jet unit prices and cost per page declined, and ink jet print quality improved and encroached on laser print quality, many buyers who were looking for desktop printing solutions priced under \$500 began considering ink jet instead of laser devices. Nonetheless, it has been difficult for ink jet to extend its reach beyond very small workgroups of one to three users. Segment 1 products have top ISO speeds of just below 20 ppm and can comfortably handle the needs of small workgroups. In order to increase the devices' print speeds, vendors would be required to design a print head that is radically different from the traditional scanning print head.

### Edgeline: Launched, Learned, Led Out of Market

HP's Edgeline color MFPs were the company's first foray into page-wide-array ink jet. HP first announced the devices in October 2006 and shipped them in the first quarter of 2007. **Figure 6** shows a list of specifications for the device.

**Figure 6: HP Edgeline Color Laser MFPs**

	CM8050	CM8060
	MFP	MFP
ISO print speed (ppm)	50 ppm	60 ppm
Maximum print speed (ppm)	57 ppm	71 ppm
First page out ready mode	<12 seconds	<12 seconds
First page out sleep mode	<35 seconds	<35 seconds
Recommended monthly volume	8,000 to 70,000 pages	15,000 to 100,000 pages
Monthly duty cycle	220,000 pages	250,000 pages
Dimensions (length × width × height in inches)	50 × 33 × 48	50 × 33 × 48
Dimensions with finisher and high-capacity input	78 × 33 × 48	78 × 33 × 48
Weight	725 lbs.	725 lbs.
List price	\$18,930	\$23,520

Source: Photizo Group and HP

As shown in **Figure 7**, these devices were behemoths that weighed 725 lbs. They were Segment 4 MFPs designed for large office environments. The CM8050 and CM8060 were very competitive with other color MFPs available in 2007 on a price/performance basis. They were priced between \$18,000 and \$24,000 and had a cost per page of 2.49 cents, which HP noted was 30 percent lower than the operating costs of competitive devices, as shown in **Figure 8**.

**Figure 7: HP's Edgeline Color Laser MFP**



Source: HP

**Figure 8: HP CM 8050 and CM8060 Cartridge Prices and Yields**

Cartridge	Price	ISO yield	Cost per page
Black	\$59	25,800	0.23 cents
Cyan	\$426	63,000	0.68 cents
Yellow	\$426	56,500	0.75 cents
Magenta	\$426	68,900	0.62 cents
Bonding agent	\$49	23,500	0.21 cents
<b>Total</b>			<b>2.49 cents</b>

Source: Photizo Group and HP

However, the Edgeline machines encountered several difficulties. As previously discussed, ink jet output on plain paper is not as vibrant as output from laser printers, and the output from the Edgeline machines was no exception. The devices were based on ink jet technology, which is perceived as a consumer rather than a business technology. Buyers were less likely to accept ink jet as a mainstream print technology for their businesses without extensive testing and a long evaluation period. The other major problem was that HP had little experience in the office MFP market.

When HP launched the Edgeline MFPs, Vyomesh Joshi, the executive vice president of HP's Imaging and Printing Group at the time, did note that the company's plan was to "launch, learn, and lead," indicating that HP did not have high expectations for sales of the Edgeline but expected to gain valuable insights for future product development.

Photizo agreed with this assessment of the Edgeline devices, and we viewed them as first-generation products. In March 2010, when HP discontinued the Edgeline devices, we anticipated that HP would introduce a new generation of products. That next generation is the Officejet Pro X.

### HP Introduces the Officejet Pro X Page-Wide-Array All-in-One

On February 11, HP introduced its page-wide-array ink jet all-in-one device, the Officejet Pro X. The device targets small and medium-size businesses (SMBs) and small office workgroups in large organizations.

As shown in **Figure 9**, the HP Officejet Pro X576 model is significantly larger than the serial-head Officejet Pro 8500, partly because of the size of its print head, ink jet cartridges, and paper path mechanism. The Officejet Pro X's size also establishes the machine as a business-class device designed to compete with desktop color laser printers and MFPs that are aimed at workgroups of three to ten employees.

Because the Officejet Pro X is designed to address the needs of larger workgroups, it is critical for it to look more like a laser printer than an ink jet device. The same can be said about the other office-level page-wide-array ink jet product that was recently introduced to the market—the Memjet line of printers.

**Figure 9: HP Officejet Pro X576 and Officejet Pro 8500**



Source: Photizo Group

### Page-Wide-Array Memjet Device Comes to Market

Silverbrook Research, a technology research company based in Australia, first introduced its page-wide-array print head in 2007, along with its partner company, Memjet. Devices using this print head are capable of printing at 60 ppm for a cost of 4 to 6 cents per page.

The announcement caused quite a stir in the market. Printer manufacturers were concerned that the device could be a game changer, and many vendors asked, "Where can I buy one?" The answer was "You can't—this was a technology demonstration."

Silverbrook and Memjet's original concept was not to develop and manufacture printers, but to license the technology to other companies that would design and build products while Memjet controlled the ink sales. The announcement was a way to generate interest among potential industry partners. But the excitement of the technology announcement did not immediately transfer to a swell of marketing. None of the active printer companies chose to partner with Memjet, mostly because page-wide-array ink jet was still an unproven technology and vendors already had a complete lineup of products. Instead, they adopted a "wait-and-see" attitude.

Eventually, Memjet had to become more involved in creating finished products. Companies that were interested in acquiring page-wide-array ink jet devices did not have experience in designing and building these types of printers. Issues such as creating a reliable paper path, head cleaning, and ink disposal methods were just some of the considerations.

### New Technology Requires New Channels: Memjet and Managed Print Services

Memjet did begin to sign on market partners, starting with LG Electronics in June 2010, when it announced the Mach LPP6010N printer, initially for the Korean printer market. Several other companies have also announced products, including Lenovo's RJ600n and RJ610N for Asia markets and Lomond's EvoJet Office and EvoJet Office 2 (see **Figure 10**) for European markets. Memjet entered the North American market on January 7, 2013, when it announced a relationship with Parts Now, which has become the initial distributor and reseller for Memjet-powered C6010 color printers in North America.

**Figure 10: Lomond's EvoJet 2 Printer**



Source: Lomond

Rather than choosing conventional printer sales channels to market these page-wide-array ink jet printers, Memjet has decided to work with Parts Now in North America and Lomond in Europe to offer its printers to managed print services (MPS) resellers that are looking for low-cost printing solutions for workgroups in managed print engagements.

Standard sales channels, such as office superstores, dealers, and even Internet/mail-order channels, which are commonly used by small businesses and small workgroups within larger businesses to make purchases, are very familiar to customers, and sell many printers to SMBs. However, the traditional sales channels pose some significant problems:

- Most of these channels have a number of locations and thus require a substantial inventory commitment on the part of the vendor. The channels often negotiate very favorable (to them) terms regarding returns of unsold devices.
- Although most of these channels have a very large Internet sales component, one of the key benefits of page-wide-array is its speed, which is best viewed in person in order to appreciate the “wow” factor. Shelf space in stores is also difficult to obtain.
- Sales support is difficult. Online product descriptions are brief. In-store sales associates, particularly at office superstores, have uneven product knowledge and are subject to rapid turnover.
- These channels usually require a commitment from vendors to promote their products. These commitments are called “market development funds” and essentially require vendors to pay for certain promotion materials, such as catalogs, e-mail blasts, and in-store promotions.
- The channels’ promotional efforts are structured primarily to advertise that a product is available, that a particular company is selling the product, and where to buy the product. It is still incumbent upon the manufacturer to promote why a particular product should be purchased instead of a different one.

Memjet’s decision to work with Parts Now to provide a desktop print solution for small workgroups that has a much lower cost-per-page than laser alternatives plays to the strengths of its page-wide-array ink jet printer. It is critical for Memjet to work with MPS providers, who must be sold on the idea of Memjet and page-wide-array technology and include these products in bids for low-end printers. Because page-wide-array is a new technology, and Memjet is an unknown company, it will be very difficult for the devices to gain acceptance in the office printing market. Very few companies can

create a market by themselves. Some healthy competition, such as HP's Officejet Pro X series, may actually help rather than hinder Memjet in this regard.

### HP Uses a Different Selling Strategy for the Officejet Pro X: MPS and Retail Presence

HP also views MPS engagements as a strong opportunity to seed Officejet Pro X products in the market. The company is already including this product in its MPS bids that require a desktop solution for small workgroups. HP also offers its Officejet Pro X products through the office superstore channels, both online and in selected stores.

As the dominant printer vendor in most channels, HP has both the presence and the resources to provide adequate inventory. It already has a support system in place, its own recognized online presence, and an established brand name. Because of its market position, it can promote this product line as the next evolutionary stage in its printer line rather than a complete standalone product.

For Memjet, the benefit of HP's Officejet Pro X is that the device will help legitimize page-wide-array ink jet technology as a viable alternative to desktop laser devices. It will also be the "other" brand for resellers who either choose not to sell HP products or do not have a relationship with HP.

Since these page-wide-array products are currently available, we can take a close look at the products and how they compare with other offerings.

### Officejet Pro X Specifications

As shown in **Figure 11**, HP is offering both printer and MFP versions of the Officejet Pro X line. The 451 and 476 models feature ISO—or professional mode—print speeds of 36 ppm and general-office mode speeds of 55 ppm. The 551 and 576 have 42 ppm ISO speeds and print at 70 ppm in general-office mode. Pricing for these devices range from \$449 for the base X451DN up to \$799 for the top-of-the line X576DW. HP will stagger its entry into different geographic regions.

**Figure 11: HP Officejet Pro X Models, Prices, and Launch Dates**

	X451DN	X451DW	X551DW	X476DN	X476DW	X576DW
	Printer	Printer	Printer	MFP	MFP	MFP
ISO print speed (ppm)	36 ppm	36 ppm	42 ppm	36 ppm	36 ppm	42 ppm
Maximum print speed (ppm)	55 ppm	55 ppm	70 ppm	55 ppm	55 ppm	70 ppm
First page out	9.5 seconds	9.5 seconds	9.5 seconds	9.5 seconds	9.5 seconds	9.5 seconds
Monthly duty cycle	50,000 pages	50,000 pages	75,000 pages	50,000 pages	50,000 pages	75,000 pages
Recommended monthly volume	500 to 2,800 pages	500 to 2,800 pages	1,000 to 4,000 pages	500 to 2,800 pages	500 to 2,800 pages	1,000 to 4,000 pages
Unit price for North America	\$449	\$499	\$599	\$649	\$699	\$799
Availability	February 2013	June 2013	February 2013	February 2013	April 2013	February 2013
Unit price for EMEA (first tier)	N/A	€ 399	€ 549	N/A	€ 649	€ 799
Availability	N/A	February 2013	February 2013	N/A	February 2013	February 2013
Unit price for EMEA (second tier)	N/A	€ 399	€ 549	N/A	€ 649	€ 799
Availability	N/A	November 2013	November 2013	N/A	November 2013	November 2013
Unit price for Asia and Japan (first tier)	N/A	\$499	\$599	N/A	\$699	\$799
Availability	N/A	February 2013	February 2013	N/A	February 2013	February 2013
Unit price for Asia and Japan (second tier)	N/A	\$499	\$599	N/A	\$699	N/A
Availability	N/A	February 2013	N/A	N/A	February 2013	N/A
Unit price for Latin America	N/A	\$449	N/A	N/A	\$649	N/A
Availability	N/A	June 2013	N/A	N/A	June 2013	N/A

Source: Photizo Group and HP



## Supplies Costs

HP offers a standard and an extra large version of the cartridges, but both have much higher page yields than most ink jet printer cartridges. The yields are closer to those that are commonly provided by laser printer cartridges, as shown in **Figure 12**. Yields are 9,200 pages in black and 6,600 pages in color for the high-yield cartridges.

Cost per page for the high-yield cartridges is 1.3 cents in black and 6.8 cents in color. It is worth noting that a full set of new ink jet cartridges for the Officejet Pro X costs nearly \$480, which is more than the price of a new X451dn. These prices are common in the color laser printer market, but they create some “sticker shock” among buyers who only consider the unit cost of the cartridges and not the yields or cost per page.

## Officejet Pro X576dw MFP Test Evaluation

Photizo tested an Officejet Pro X576dw unit to evaluate HP’s new Officejet Pro X series. Eight basic steps were required to set up the device. A CD-ROM enclosed with the device included the drivers and instructions for setting up the Wi-Fi network, but drivers were also available online.

**Figure 13: HP Officejet Pro X Ink Cartridges**



Source: Photizo Group

**Figure 12: HP Officejet Pro X Supplies Prices and Yields**

Standard Yield				
Product number	970 black	971 cyan	971 magenta	971 yellow
ISO page yield	3,000	2,500	2,500	2,500
Cartridge price	\$74.99	\$79.99	\$79.99	\$79.99
ISO cost per page	2.5 cents	9.4 cents CMY, 11.9 cents CMYK		
High Yield				
Product number	970XL black	971XL cyan	971XL magenta	971XL yellow
ISO page yield	9,200	6,600	6,600	6,600
Cartridge price	\$119.99	\$119.99	\$119.99	\$119.99
ISO cost per page	1.3 cents	5.5 cents CMY, 6.8 cents CMYK		

Source: Photizo Group and HP

## Supplies

A 500-sheet paper drawer allows a full ream of paper to be loaded, which is similar to the paper trays featured in office-class laser devices rather than typical serial-head ink jet printers. There is also a 50-sheet multipurpose tray on the right side of the machine.

HP includes a set of ink cartridges (see **Figure 13**) with the device to prime the system. These “setup” cartridges provide standard ink cartridge yields of 3,000 pages for black and 2,500 pages for cyan, magenta, and yellow (CMY). A printer status report page printed on May 3, 2013 listed a total page count of 1,354 pages printed and 961 color pages printed with the setup cartridges. The approximate number of remaining pages included 1,250 yellow pages, 850 cyan pages, and 1,200 magenta pages. The black pages were listed as “low.” The estimated remaining ink level was approximately 20 percent for black.

The permanent print head is sealed within the printer, and the user has no access to it. The print head cannot be replaced in the field. The printer must be returned to a service center if the print head fails.

## Speed Tests

For our speed tests, we printed a Microsoft Word document with an embedded pie chart, a standard document type that many office users print. HP lists a time to first print as low as 9.5 seconds. From “sleep” mode, the first page printed in approximately 15 seconds. From “ready” mode, the first page printed in about 10.5 to 12.5 seconds from “click to clunk.” Ten copies of a one-page document, again from “click to clunk,” took 28.9 seconds in “professional” mode and 21.5 seconds in “general office” mode.



**Paper Feeding**

Papers we tested ranged from 20 lb. standard office paper to 48 lb. ink jet brochure paper. There were no paper-feed difficulties. Approximately half of the pages were printed in duplex mode. The mechanism worked smoothly. The automatic document feeder and scanner worked without difficulty.

Although the duplex mechanism worked without difficulties, print speeds slowed. A 10-page text document took 38 seconds to print in duplex mode.

**Printing from Mobile Devices**

HP's ePrint solutions provides mobile printing capability. Documents sent from both iPhones and iPads printed without difficulty.

**Print Quality**

We used papers with a number of different base weights and brightness levels to test print quality. For comparison purposes, we also printed a sample from a Canon imageRUNNER ADVANCE C5030 on HP ColorLok 97 brightness, 90 gm paper at 1,200 dpi. The goal was not to determine overall best quality but to establish what is now considered "office quality" for laser printers and judge what may be "good enough" for office use.

The print sample we used for most tests was the Microsoft Word document mentioned above, which simulated typical output that might be produced in an office environment. This also served as a test for fills and potential paper cockling.

Additional papers used in our tests include OfficeMax's 30 percent recycled 92 bright, 20 lb. paper, Georgia Pacific 96 bright, 22 lb. ColorLok paper, and Printworks's professional matte-finish 92 bright, 24 lb. paper.

The Canon laser output was somewhat crisper than the Officejet output. Viewed through an eye loupe, the C5030 output featured finer lines and slightly better characters, and the pie chart colors had a slightly glossy finish. In lighter-color areas, some dot patterns were detectable, but they were uniform.

The Officejet Pro X output varied slightly by paper and mode. Text printed in general office mode was generally formed well, although upon close inspection, some jagged lines were detected on diagonals and curves. Those irregularities disappeared in professional (default) and presentation (highest quality) modes. Output printed on the OfficeMax recycled paper was a bit light, although it was still quite legible and would likely be adequate for internal office use. On other media, all modes provided acceptable text output.

Graphics output showed no banding on any media. While it did not have the gloss found on the Canon laser output, graphics output printed in both professional and presentation mode had higher color saturation. There was no visible dot pattern on the graphics printed in any mode. There was slight jaggedness on the black lines separating pie segments in output printed in general office mode, but none were detected in professional or presentation modes, although the lines were slightly thicker than they were in the laser output.

One sample printed on the Printworks professional matte-finish paper in professional mode featured some slight cockling in the pie chart. Subsequent tests using the same paper in the same mode showed no such effects.

Photizo used different highlighter brands and colors to test the output's waterfastness. We applied the highlighter pens to pages that had been printed from both devices on the previous day, as well as pages that had just been printed and immediately removed from the output trays. We did not detect any smearing on any of the standard text pages that we had printed on the previous day. On pages that were immediately taken from the output tray, a slight shadow appeared after some of the bold characters. These shadows were detectable upon very close inspection after we highlighted the text using a Berol yellow highlighter and an Eberhard Faber 4009 pink highlighter.

Another test using Avery's glossy white Clean Edge Business Cards was successful and yielded high-quality output.

**Front-Panel Design**

The Officejet Pro X576dw shares the same front touch-panel design as the Officejet Pro 8600. All standard MFP features are displayed in graphic and text format. It also has an Apps feature that provides a range of different apps that can be

accessed from HP's ePrint library. Some, such as Times Digest, can be set for automatic scheduled delivery. The Officejet Pro X576dw does not have all of the front-panel features that are found in HP's enterprise-level MFPs, however, because the current Officejet Pro X series is designed more for small workgroups rather than large or departmental workgroups.

### Distribution Channels

The HP Officejet Pro X series has broad distribution, most notably through office superstore websites and select retail locations. HP is leveraging its position as the top printer brand in this channel. In addition, HP is including the Officejet Pro X in MPS bids through its MPS dealers as a low-cost alternative for workgroups in larger corporate engagements.

### Memjet C6010 Specifications

Memjet provided one of its C6010 printers to Photizo for evaluation. Because Memjet is selling its devices to MPS dealers through Parts Now rather than using a traditional retail distribution channel, its products have no official price. However, the company estimates that the C6010 costs approximately \$995 to \$1,200 per unit.

### Memjet C6010 Test Evaluation

The package that Memjet sent to us included the printer, cartridges, print head, driver CD-ROM, and a 16-step instruction sheet that consisted of easy-to-understand pictures with text limited to a screen shot of the two-line LCD front panel. Setup was not difficult, and installing the print head was surprisingly simple. The instructions were quite clear, and the print head easily snapped into place.

The drivers loaded easily from the CD-ROM, but drivers are also available via the company's website for computers that have no CD-ROM drive, such as Apple's MacBook Air.

### Supplies

Ink cartridges for the Memjet C6010 were also easily loaded (see **Figure 14**).

As shown in **Figure 15**, the estimated yield for the black cartridge is 4,600 pages. Based on Memjet's tests, the yield varies between 4,830 and 7,510 pages by color. Since Memjet sells its products to MPS dealers through Parts Now, there are no set supplies prices—dealers set prices in their contracts. However, Memjet estimates that the cost per page for ink will be about 5 to 6 cents per page overall. The cartridges are refillable via dealer refill stations. Paper capacity in the main paper drawer is 250 sheets, which is comparable to the capacity of Segment 2 A4 laser MFPs.

### Speed Tests

For our speed tests, we used the same Microsoft Word document that we used to test HP's Officejet Pro X. Time to first print was approximately 10.5 seconds, and 10 copies of the document printed in 21.5 seconds.

### Paper Feeding

Papers we tested ranged from 20 lb. standard office paper to 48 lb.

**Figure 14: Memjet C6010 Ink Cartridges**



Source: Photizo Group

ink jet brochure paper. There were no paper-feed difficulties. Approximately half of the pages were printed in duplex mode. The mechanism worked smoothly. The automatic document feeder and scanner worked without difficulty.

The current Memjet C6010 model does not feature automatic duplex, but it does have a manual duplex function. When manual duplex mode is selected, one side of the page is printed and falls into the output tray. That page is then reloaded into the paper input tray without being flipped or turned. The user must push the start button on the front panel, and the other side of the pages are printed in order. The 117-page document we used for the test—the PDF of the Memjet manual—fed flawlessly.

Because the ink is given time to dry while it is in the output tray and during the transfer back into the input tray, the reverse page is printed at normal speed.

The manual duplex capability works well for longer documents but is less convenient for short two to ten-page documents. According to Kim Beswick, vice president of marketing for Memjet's Home and Office group, Memjet is developing automatic duplex capability for future models.

### Print Quality

The print sample we used for most tests was the Microsoft Word document mentioned above, which simulated typical output that might be produced in an office environment. This also served as a test for fills and potential paper cockling.

To test the C6010's print quality, we used OfficeMax's 30 percent recycled 92 bright, 20 lb. paper, Georgia Pacific 96 bright, 22 lb. ColorLok paper, and Printworks's professional matte finish 92 bright, 24 lb. paper.

Output quality from the Memjet C6010 varied somewhat by paper type. Text quality was quite sharp, with well-formed characters and no jaggedness on diagonals or curves, likely as a result of the print head's very small drop size. Graphics output showed no banding on any media, but it did not have the gloss found on the laser output.

Text appeared somewhat gray, and color graphics were muted on OfficeMax recycled paper, but this may be adequate for output intended for internal use. The Georgia Pacific 22 lb. paper yielded somewhat better results, with darker blacks and somewhat more vibrant colors. Memjet provided us with Printworks professional paper for the tests, and it did yield the best results. Output printed on this paper featured well-formed and dark black characters and vibrant colors that were quite competitive with laser output.

Photizo again used different highlighter brands and colors to test the output's waterfastness. Pages that had sufficient time to dry showed no smudging when we applied the highlighter pens to the text. Pages that we marked with the highlighters immediately after printing generally did fine. Only one yellow highlighter caused a slight smudge on the recycled paper. Generally, smudging was not an issue, even though the Memjet C6010 uses dye-based inks.

**Figure 15: Memjet C6010 Specifications**

How much?	
Street price	\$995 - \$1,299
Availability	January 2013
How fast and what image quality?	
Print technology	Color ink jet
Duplex (two-sided printing)	Manual
Cost per page (black/CMY color) based on high-capacity cartridges, where available	4 - 6 cents
Print speed (ISO)	60 ppm
Maximum print speed	
First page out	10 seconds
Input capacity standard	250 sheets
Input capacity maximum	270 sheets
Output capacity	125 sheets
Monthly duty cycle	60,000 pages
Recommended use	1,000 to 4,000 pages
Black toner/ink yield, standard	4,600 pages
Black toner/ink yield, high capacity	N/A
Color toner/ink yield standard	Cyan: 7,510 pages Magenta: 4,830 pages Yellow: 5,050 pages
Color toner/ink yield high capacity	N/A
Dimensions (width × height × depth in inches)	21.3 × 10.4 × 18
Weight	27 lbs.

Source: Photizo Group and Memjet

Bill McGlinn, CEO of Memjet's Home and Office group, noted that the C6010 is capable of printing full-bleed brochures, which is important for companies that want to produce marketing materials. We were unable to test the capability this time, but we will try to print some full-bleed documents in subsequent tests.

We also tested the C6010 using Avery's glossy white Clean Edge Business Cards, which yielded high-quality results. Pages fed perfectly through the second paper tray's straight paper path. Paper fed through the first tray was slightly skewed. The print quality was crisp, and the high-gloss paper settings yielded bold colors.

## Our View of the Printer Evaluations

Both the HP Officejet Pro X576dw and the Memjet C6010 delivered what they promised, with print speeds that pretty much lived up to claims the companies made in their advertising. There were no particular flaws in setup or operation, and paper moved through the printers very rapidly and smoothly.

Print quality is often in the eye of the beholder, but it also depends upon the application and the audience for the output. Internal documents generally just need to be legible, while external documents intended for customers have much higher print-quality requirements. Our opinion is that if laser print quality is better, it is only marginally better. A gating factor is the paper, and even laser output will only be suitable for internal use if it is printed on low-grade recycled paper. Considering that users are often more concerned with a document's content rather than minute differences in edge acuity, blackness of text, or gloss of the color output, the print-quality playing field may truly be level.

Since there were only negligible smearing issues on newly printed pages, output waterfastness also appears to be a minimal issue. Competitors will likely try to make stronger cases for both waterfastness and print quality, but both issues appear to be nothing more than a "tempest in a teapot," if that.

These page-wide-array ink jet devices also feature a couple of "wow" factors. The print speeds of both the HP Officejet Pro X 576dw MFP and the Memjet C6010 have impressed current laser users during demonstrations. The cartridges' low cost per page and high yields impress printer operators and buyers. The next section looks at how these page-wide-array printers compare to different levels of color laser MFPs.

## Competition: Higher Speed and Lower Cost per Page

Printer buyers usually have a specific budget number in mind when they purchase printers. Devices that are priced within the same range as the HP Officejet Pro X and the Memjet C6010 are Segment 2 (21-29 ppm) A4 color laser MFPs.

Page-wide-array ink jet products either meet or exceed comparable color laser devices in a number of different performance parameters. Color laser MFPs that are in the same price category as these devices have higher black and color per-page costs than either the HP Officejet Pro X models or the Memjet C6010 (see **Figure 16**). The ISO speeds of the page-wide-array ink jet devices are considerably higher than those of the color laser MFPs. The HP Officejet Pro X models also feature a general office mode that prints at 55 ppm in the 400 series (451 and 476) and 70 ppm in the 500 series (551 and 576), more than double the speed of the Segment 2 color laser MFPs.

The page-wide-array devices are also priced significantly lower than Segment 2 color laser MFPs, though direct comparisons for the Memjet device are difficult because Memjet sells its hardware and supplies through different channels. Taking all of this into consideration, page-wide-array ink jet devices appear to offer much better value to customers than Segment 2 color laser MFPs.

## Comparisons with Segment 3 A4 Color Laser MFPs

The page-wide-array ink jets have less of an advantage when they are compared to Segment 3 (30-40 ppm) A4 color laser MFPs. As shown in **Figure 17**, the ink jet machines may be faster, but the laser devices are on the same level with or exceed the ink jet machines' usage rates and cartridge yields and have a very similar cost per page. The color laser MFPs are much more robust.

**Figure 16: New HP Officejet Pro X and Memjet C6010  
versus Segment 2 A4 Color Laser MFPs**

	HP Color LaserJet Pro 400 color MFP M475dn	Dell 2155cn	HP Officejet Pro X451DN Printer	HP Officejet Pro X576DW MFP	Memjet C6010	Samsung CLX-6260FD
<b>How much?</b>						
Street price	\$699.00	\$519.99	\$449.00	\$799.00	\$995 - \$1,299	\$857.99
Availability	May 2012	June 2012	February 2013	February 2013	January 2013	July 2012
Cost per page per minute	\$33.29	\$24.76	\$12.47	\$14.53	\$16.58	\$34.32
Print technology	Color laser	Color laser	Color ink jet	Color ink jet	Color ink jet	Color laser
Duplex (two-sided printing)	Standard	Standard	Standard	Standard	Manual	Standard
Cost per page (black/CMY color) based on high-capacity cartridges, where available	2.6 cents black 13.8 cents color	3.3 cents black 12.3 cents color	1.3 cents black 6.8 cents color	1.3 cents black 6.8 cents color	4 - 6 cents	2.3 cents black 14.2 cents color
Print speed (ISO)	21 ppm	24 ppm	36 ppm	55 ppm	60 ppm	25 ppm
Maximum print speed	N/A	N/A	55 ppm	70 ppm	N/A	N/A
First page out	17 seconds	N/A	9.5 seconds	9.5 seconds	10 seconds	17 seconds
Input capacity standard	250 sheets	250 sheets	550 sheets	550 sheets	250 sheets	250 sheets
Input capacity maximum	1,050 sheets	251 sheets	1,050 sheets	1,050 sheets	270 sheets	820 sheets
Output capacity	150 sheets	150 sheets	300 sheets	300 sheets	125 sheets	150 sheets
Monthly duty cycle	40,000 pages	40,000 pages	50,000 pages	75,000 pages	60,000 pages	60,000 pages
Recommended use	1,000 to 2,500 pages	N/A	500 to 2,800 pages	1,000 to 4,200 pages	1,000 to 4,000 pages	N/A
Black toner/ink yield, standard	2,200 pages	1,200 pages	3,000 pages	3,000 pages	4,600 pages	2,000 pages
Black toner/ink yield, high capacity	4,000 pages	3,000 pages	9,200 pages	9,200 pages	n/a	6,000 pages
Color toner/ink yield standard	2,600 pages	1,200 pages	2,500 pages	2,500 pages	Cyan: 7,510 pages Magenta: 4,830 pages Yellow: 5,050 pages	1,500 pages
Color toner/ink yield high capacity	N/A	2,500 pages	6,600 pages	6,600 pages	N/A	3,500 pages
Dimensions (width × height × depth in inches)	16.5 × 19.0 × 19.7	17.2 × 21.1 × 22.8	20.3 × 15.7 × 15	20.3 × 15.7 × 20.3	21.3 × 10.4 × 18	16.5 × 17.8 × 18.8
Weight	65 lbs.	66.1 lbs.	37.8 lbs.	53 lbs.	27 lbs.	54.7 lbs.

Source: Photizo Group and vendor websites

Figure 17: New HP Officejet Pro X versus Segment 3 A4 Color Laser MFPs

	HP LaserJet Enterprise 500 MFP M570dn	Lexmark CX410e	HP Officejet Pro X451DN Printer	HP Officejet Pro X576DW MFP	Memjet C6010	Xerox WorkCentre 6605DN
How much?						
Street price	\$1,399.00	\$699.00	\$449.00	\$799.00	\$1,299 - \$995	\$1,099.00
Availability	May 2012	N/A	February 2013	February 2013	January 2013	July 2012
Cost per page per minute	\$45.13	\$21.84	\$12.47	\$14.53	\$16.58	\$30.53
Print technology	Color laser	Color laser	Color ink jet	Color ink jet	Color ink jet	Color laser
Duplex (two-sided printing)	Standard	Standard	Standard	Standard	Manual	Standard
Cost per page (black/CMY color) based on high-capacity cartridges, where available	1.8 cents black 13.2 cents color	2.4 cents black 10.5 cents color	1.3 cents black 6.8 cents color	1.3 cents black 6.8 cents color	4 - 6 cents	2.4 cents black 14.2 cents color
Print speed (ISO)	31 ppm	32 ppm	36 ppm	55 ppm	60 ppm	36 ppm
Maximum print speed	N/A	N/A	55 ppm	70 ppm	N/A	N/A
First page out	10.5 seconds	10.5 seconds	9.5 seconds	9.5 seconds	10 seconds	9 seconds
Input capacity standard	350 sheets	251 sheets	550 sheets	550 sheets	250 sheets	700 sheets
Input capacity maximum	850 sheets	1,451 sheets	1,050 sheets	1,050 sheets	270 sheets	1,250 sheets
Output capacity	250 sheets	150 sheets	300 sheets	300 sheets	125 sheets	150 sheets
Monthly duty cycle	75,000 pages	75,000 pages	50,000 pages	75,000 pages	60,000 pages	80,000 images
Recommended use	2,000 to 6,000 pages	800 to 6,000 pages	500 to 2,800 pages	1,000 to 4,200 pages	1,000 to 4,000 pages	N/A
Black toner/ink yield, standard	5,500 pages	2,500 pages	3,000 pages	3,000 pages	4,600 pages	3,000 pages
Black toner/ink yield, high capacity	11,000 pages	4,000 pages	9,200 pages	9,200 pages	N/A	8,000 pages
Color toner/ink yield standard	6,000 pages	2,500 pages	2,500 pages	2,500 pages	Cyan: 7,510 pages Magenta: 4,830 pages Yellow: 5,050 pages	2,000 pages
Color toner/ink yield high capacity	N/A	3,000 pages	6,600 pages	6,600 pages	N/A	6,000 pages
Dimensions (width × height × depth in inches)	20.3 × 19.7 × 21.2	18.44 × 17.48 × 21.99	20.3 × 15.7 × 15	20.3 × 15.7 × 20.3	21.3 × 10.4 × 18	16.9 × 20.8 × 22
Weight	90 lbs.	60.25 lbs.	37.8 lbs.	53 lbs.	27 lbs.	71.7 lbs.

Source: Photizo Group and vendor websites



### Comparisons with Segment 4 A4 Color Laser MFPs

Comparisons with Segment 4 (41-69 ppm) A4 color laser MFPs are less favorable (see **Figure 18**). Although the unit prices for the page-wide-array ink jet devices are much lower than those of Segment 4 MFPs, the speeds are now comparable. Cartridge yields and duty cycles are much higher than the ink jet machines, making the Segment 4 MFPs much more suitable for larger workgroups. It should also be noted that one of the competitive products, the Xerox ColorQube 8700, is a page-wide-array solid ink jet device that is competitive with color laser MFPs but is designed for departmental use.

**Figure 18: New HP Officejet Pro X versus Segment 4 A4 Color Laser MFPs**

	HP Color LaserJet Enterprise CM4540f MFP	Lexmark X792de	HP Officejet Pro X576DW MFP	Memjet C6010	Xerox ColorQube 8700	Samsung CLX-8540ND
How much?						
Street price	\$4,499.00	\$4,299.00	\$799.00	\$1,299 - \$995	\$2,499.00	\$2,995.00
Availability	May 2012	June 2012	February 2013	January 2013	January 2013	July 2012
Cost per page per minute	\$107.12	\$85.98	\$22.19	\$16.58	\$56.80	\$74.88
Print technology	Color laser	Color laser	Color ink jet	Color ink jet	Solid ink jet	Color laser
Duplex (two-sided printing)	Standard	Standard	Standard	Manual	Standard	Standard
Cost per page (black/CMY color) based on high-capacity cartridges, where available	1.2 cents black 14.2 cents color	3.3 cents black 12.3 cents color	1.3 cents black 6.8 cents color	4 - 6 cents	1.8 cents black 12.4 cents color	2.3 cents black 14.2 cents color
Print speed (ISO)	42 ppm	50 ppm	55 ppm	60 ppm	44 ppm	40 ppm
Maximum print speed	N/A	N/A	70 ppm	N/A	N/A	N/A
First page out	11.5 seconds	8 seconds	9.5 seconds	10 seconds	8.5 seconds	14 seconds
Input capacity standard	650 sheets	600 sheets	550 sheets	250 sheets	625 sheets	520 sheets
Input capacity maximum	2,150 pages	1,150 sheets	1,050 sheets	270 sheets	3,475 sheets	2,620 sheets
Output capacity	500 sheets	500 sheets	300 sheets	125 sheets	350 sheets	500 sheets
Monthly duty cycle	175,000 pages	150,000 pages	75,000 pages	60,000 pages	120,000 images	100,000 pages
Recommended use	5,000 to 9,000 pages	2,500 to 17,000 pages	1,000 to 4,200 pages	1,000 to 4,000 pages	1,000 to 6,000 pages	N/A
Black toner/ink yield, standard	8,500 pages	6,000 pages	3,000 pages	4,600 pages	2,250 pages	20,000 pages
Black toner/ink yield, high capacity	17,000 pages	20,000 pages	9,200 pages	N/A	N/A	N/A
Color toner/ink yield standard	12,500 pages	6,000 pages	2,500 pages	Cyan: 7,510 pages Magenta: 4,830 pages Yellow: 5,050 pages	2,100 pages	15,000 pages
Color toner/ink yield high capacity	n/a	20,000 pages	6,600 pages	N/A	N/A	N/A
Dimensions (width × height × depth in inches)	35.8 × 26.3 × 44.1	32.5 × 22.0 × 20.0	20.3 × 15.7 × 20.3	21.3 × 10.4 × 18	21.3 × 10.4 × 18	23.9 × 22.6 × 32.1
Weight	166.5 lbs.	161 lbs.	53 lbs.	27 lbs.	27 lbs.	157.6 lbs.

Source: Photizo Group and vendor websites

### Brother's HL-S7000DN, a 100 ppm Monochrome Page-Wide-Array Ink Jet Printer

There is one other page-wide-array ink jet printer that is currently available. Brother is offering the HL-S7000db, a 100 ppm monochrome page-wide-array ink jet printer. As shown in **Figure 19**, this printer has a considerably higher unit price but a much lower cost per page. It is designed for certain niche markets that produce a high volume of monochrome pages.

Although Brother has announced the printer and it does appear on its website, the company has not made a concerted effort to promote the product. Brother's strategy generally is to remain relatively passive in its marketing effort. Instead, it focuses on being the alternative to the market leader, rather than being the leader itself.

The HL-S7000db shows the direction that page-wide-array technology may potentially take in the future, but it does not affect HP or Memjet's offerings, which address small office workgroups and SMBs with fewer than 10 employees.

### Micro Businesses Embrace Business Ink Jet Devices, but SMBs Are Less Enthusiastic

The biggest challenge for HP, or any other page-wide-array ink jet printer vendor, is convincing buyers—particularly IT managers—that ink jet devices are not just consumer products. As shown in **Figure 20**, Photizo's 2011 U.S. Small and Medium-Size Business Printer User Survey found that users in micro businesses, or those with one to nine employees, view ink jet printers very favorably. The survey asked whether respondents agreed or disagreed that various ink jet and laser printer attributes were acceptable. Micro business users actually favored ink jet over laser printers for all attributes, except for speed. Not surprisingly, many of the micro business respondents used ink jet printers for business printing.

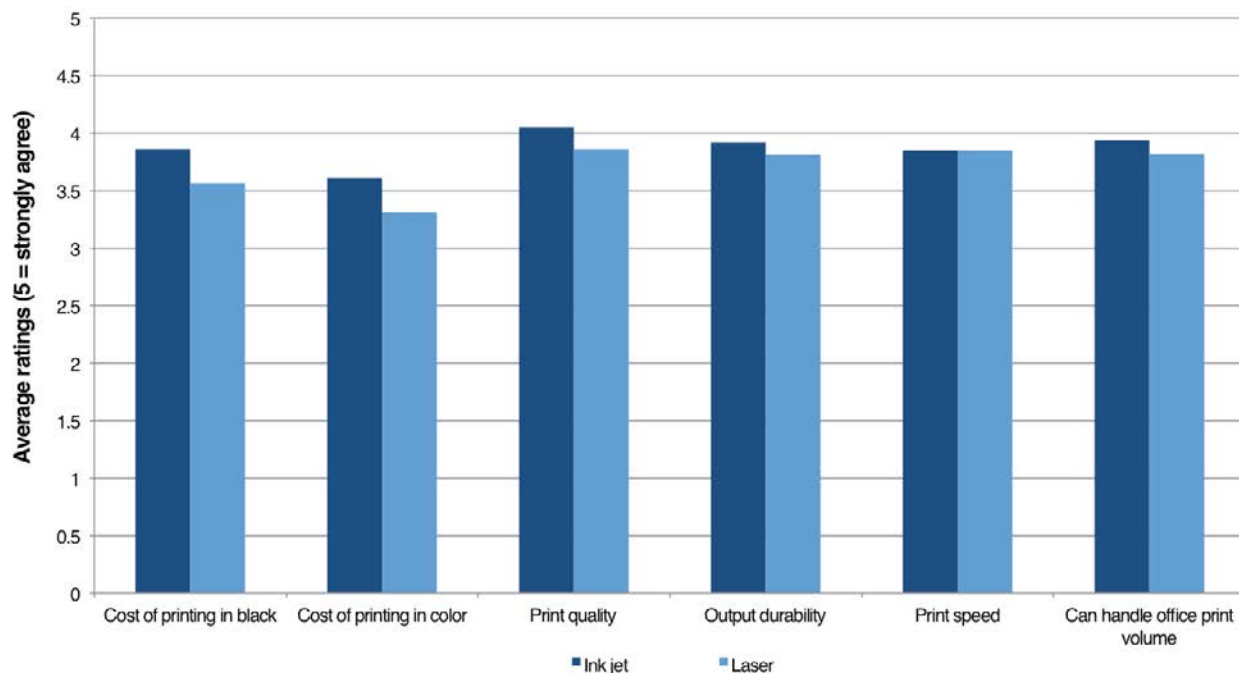
Conversely, as shown in **Figure 21**, users from businesses that have 10 or more employees favored laser printers for all attributes. These respondents primarily use laser printers and usually do not have many ink jet printers in the office. When they do, the devices are typically low-cost consumer models that use low-volume ink cartridges that are expensive on a per-page basis and require frequent changing. IT managers prefer to have fewer printers to service and support and commonly try to replace many ink jet devices with a smaller number of shared laser printers and MFPs. Although ink jet manufacturers have worked diligently to bring new business-class ink jet printers to market, ink jet devices with serial print heads are still relatively slow compared to laser devices, although they are much more cost effective on a per-page basis.

**Figure 19: Brother HL-S7000db Specifications**

How much?	
Street price	\$3,499 (Australia)
Availability	October 2012
Cost per page per minute	\$34.99
Print technology	Monochrome ink jet
Duplex (two-sided printing)	Standard
Cost per page (black/CMY color) based on high-capacity cartridges, where available	<1 cent
Print speed (ISO)	100 ppm
Maximum print speed	
First page out	<8.5 seconds
Input capacity standard	600 sheets
Input capacity maximum	2,100 sheets
Output capacity	500 sheets
Monthly duty cycle	275,000 pages
Recommended use	5,000 to 20,000 pages
Black toner/ink yield, standard	30,000 pages
Black toner/ink yield, high capacity	N/A
Color toner/ink yield standard	N/A
Color toner/ink yield high capacity	N/A
Dimensions (width × height × depth in inches)	18.8 × 18.7 × 23.3
Weight	114.6 lbs.

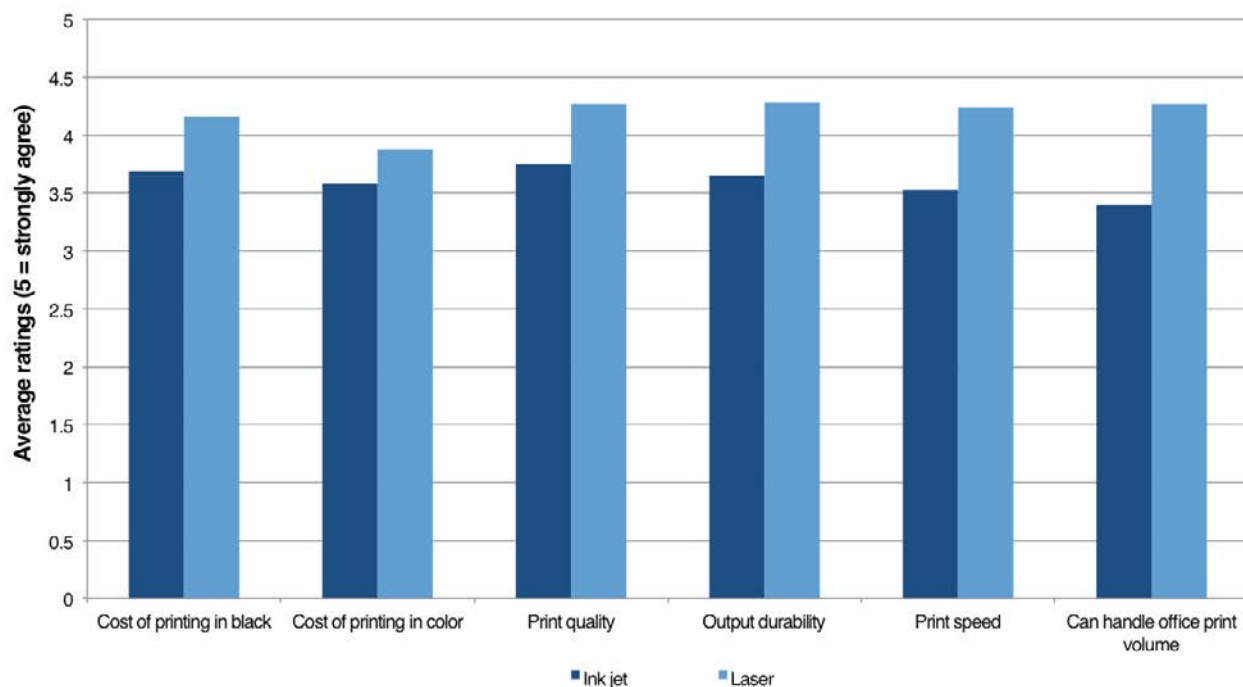
Source: Photizo Group and Brother International

**Figure 20: Ratings for Print Technology Features among U.S. SMB Printer Users from Businesses with One to Nine Employees, 2011**



Source: Photizo Group, 2011 U.S. Small and Medium-Size Business Printer User Survey

**Figure 21: Ratings for Print Technology Features among U.S. SMB Printer Users from Businesses with 10 or More Employees, 2011**



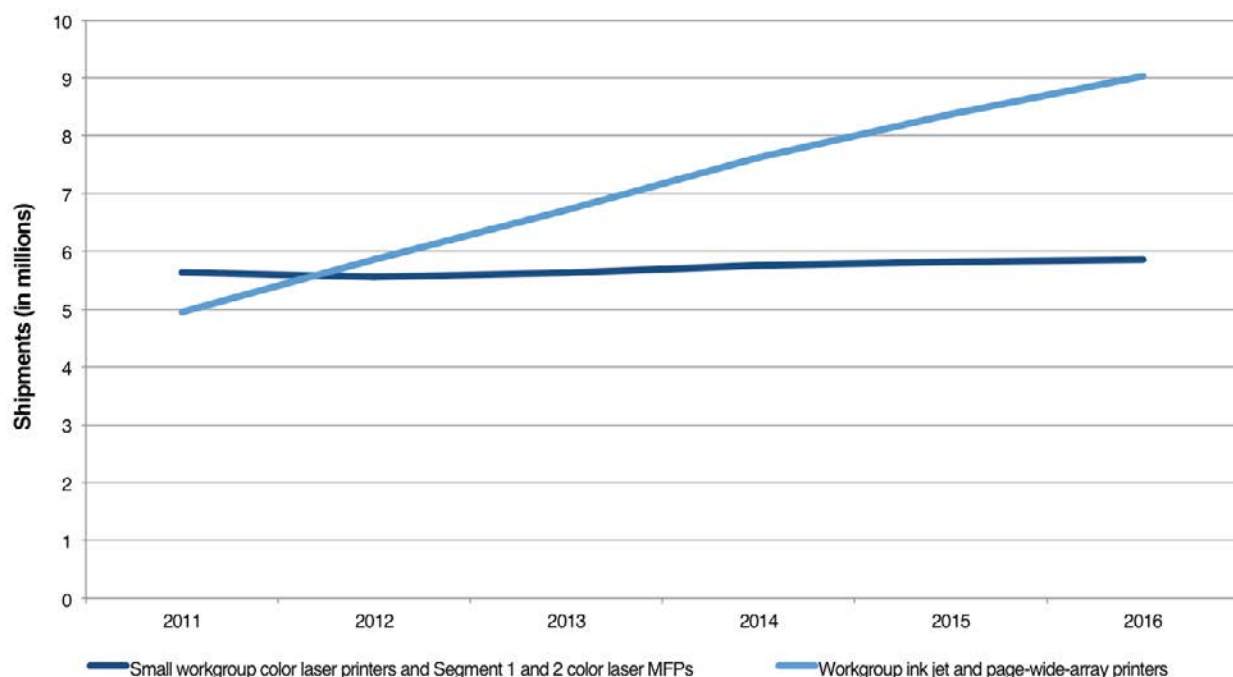
Source: Photizo Group, 2011 U.S. Small and Medium-Size Business Printer User Survey

In the past, ink smear was a problem, particularly for dye-based inks that could smudge easily. Ink formulations have improved, and many of the newer business ink jet printers employ pigment-based inks that dry rapidly and do not smudge. The Officejet Pro X uses a new ink formulation that dries by the time the paper reaches the output tray. Although Memjet uses a dye-based ink that has been known for issues with smearing, it was not evident in our tests.

## The Market: Workgroup Ink Jet Printer Shipments Are Expected to Grow

The desktop printer market is facing serious challenges as a result of the proliferation of MPS engagements that remove desktop printers and replace them with Segment 3-5 laser MFPs. Screen-based media is also displacing printed output and putting more pressure on the low-end printer market. The one growth area, particularly in the ink jet printer market, has been workgroup devices that can be shared in both home and office environments. Because page-wide-array products are new to the market, they are included in the overall workgroup ink jet segment shown in **Figure 22**.

**Figure 22: Worldwide Workgroup Ink Jet AIO and Small Workgroup Color Laser Printer and Segment 1 and 2 Color Laser MFP Shipments, 2011-2016**



Source: Photizo Group, Hardware Advisory Service, December 2012

MPS engagements usually call for the replacement of many low-end desktop printers with a few office MFPs that have a lower cost per page, thereby reducing the number of devices that will require service. Higher-end office MFPs may not always be the most cost-effective solution for small workgroups of fewer than 10 employees, but the laser devices designed for these small workgroups have a high cost per page, especially for color printing. There is a need for an alternative.

## Future Developments

Currently, the Officejet Pro X and the Memjet C6010 primarily address companies with fewer than 10 employees. However, if the current generation of these products can compete in this market segment and gain market momentum, future printers will likely be faster and perhaps will have A3 capability, more robust paper handling and feature sets, and ink jet cartridges that have higher yields and lower cost per page.

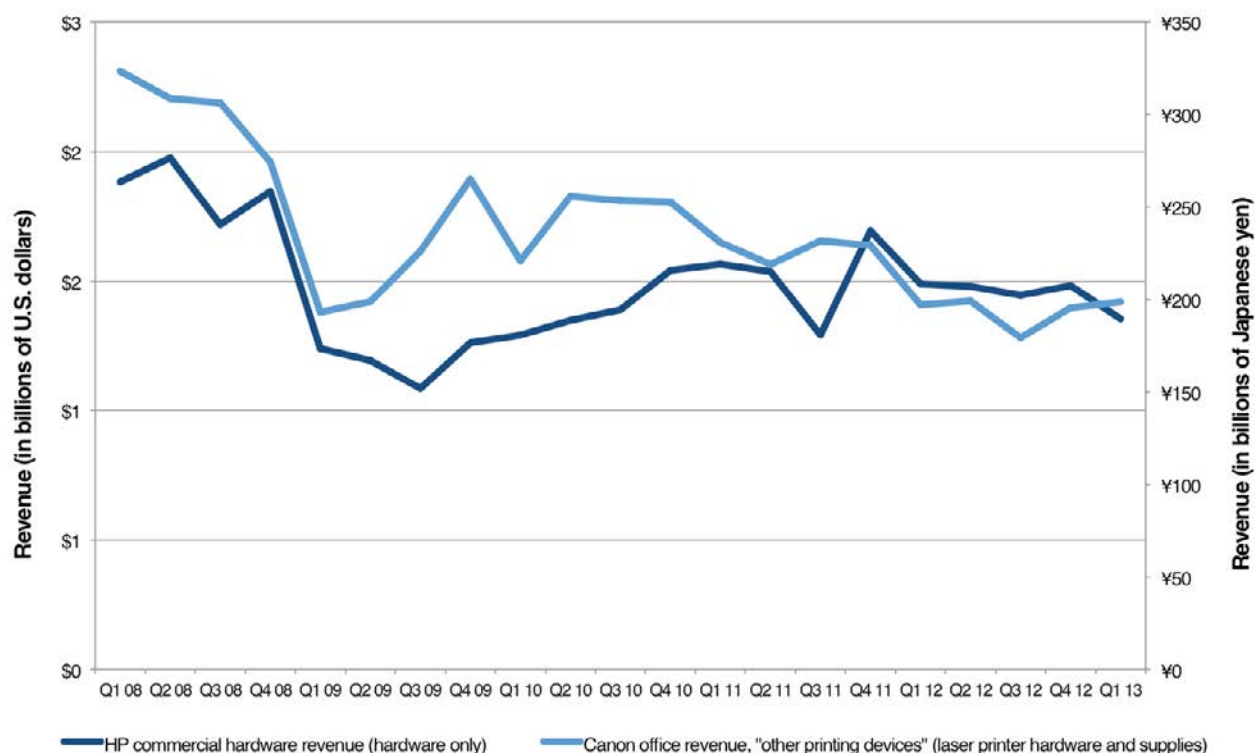
Brother's 100 ppm ink jet printer shows that higher speeds are attainable for page-wide-array devices. Eliminating the horizontal print-head motion by using a page-wide array makes print-speed improvements a matter of increasing paper-feed speeds and increasing print-head firing frequency, or perhaps including multiple heads. These may be nontrivial tasks, but speed improvements certainly have been made to laser devices, which means that similar improvements can be made in print speeds and higher average monthly page-volume ratings, larger capacity supplies, and a broader range of paper-handling options are all possible for the next generation of page-wide-array ink jet products. The current iterations are merely small but critically important stepping-stones for future development.

## Canon and HP: A 30-Year Relationship

If HP's Officejet Pro X series is successful and it expands into additional office segments, it will have a significant impact on HP's laser OEM partner, Canon. The longevity of the Canon/HP relationship is rather unique. The first HP LaserJet, which was introduced in 1984, was based on the Canon LBP-CX engine and, with the exception of the first color LaserJet and a couple of midrange copiers provided by Konica Minolta, virtually every LaserJet has had a Canon engine. Canon also had agreements with several other companies, including Apple and QMS, but eventually settled into an exclusive relationship with HP.

Over the course of their 30-year relationship, both companies have weathered several market ups and downs, including several recessions and the Y2K scare, but recent developments show that the market may have changed permanently. As shown in **Figure 23**, both companies had strong laser revenue in early 2008, followed by a precipitous decline in late 2008 and 2009. Although revenue rebounded from 2009 lows in 2010 and 2011, it never reached the levels of 2008 and is generally declining.

**Figure 23: HP and Canon Revenue for Laser Segments, First-Quarter 2008 to First-Quarter 2013**



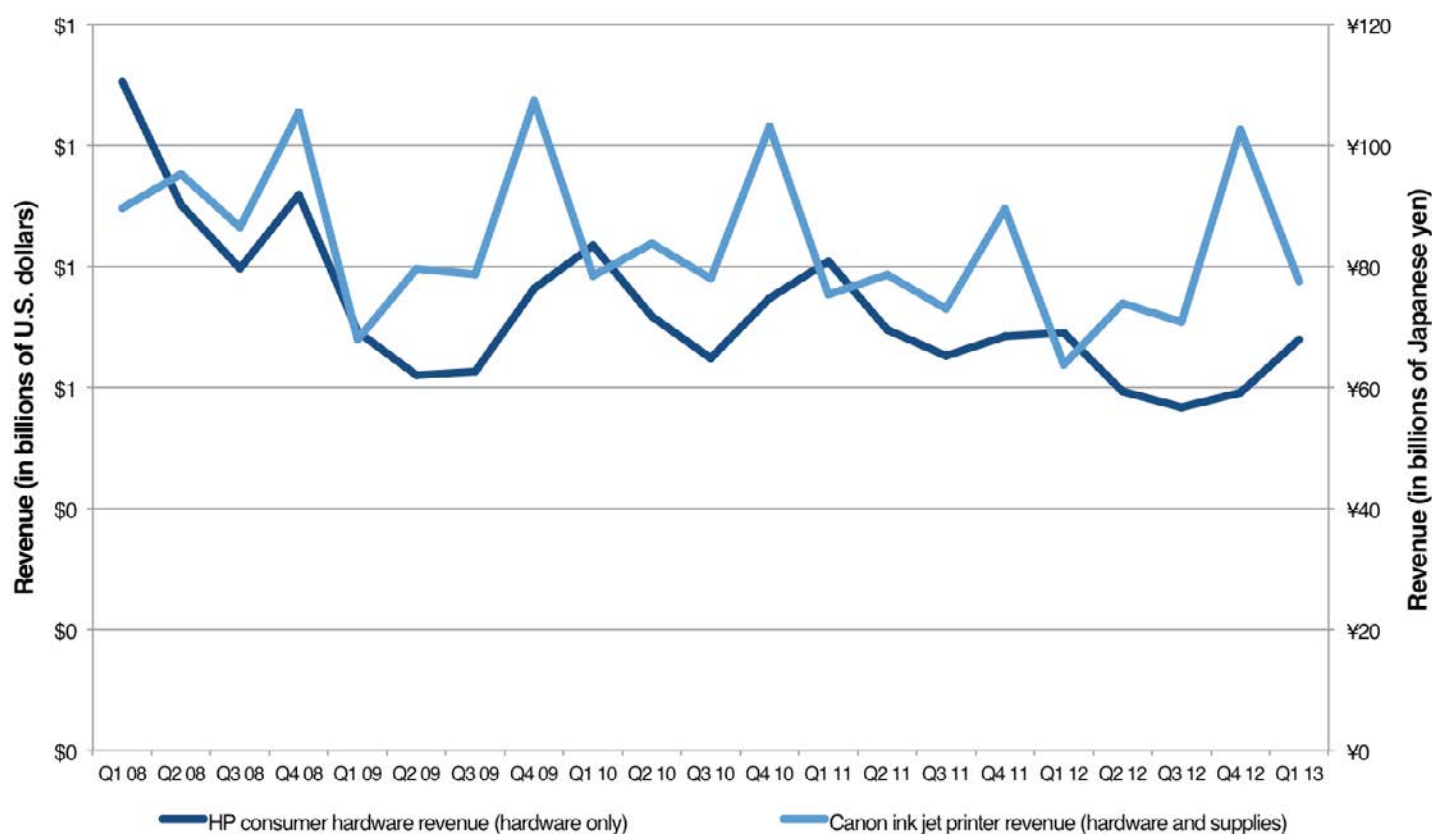
Source: Photizo Group and HP and Canon annual reports

HP realized that it was necessary to look for new opportunities in the face of declining laser sales, and ink jet devices allowed the company to improve its financial position. Because HP manufactures the machines itself, it does not share the profits with an OEM partner.

This is a concern for Canon because HP devices accounted for approximately 86 percent of Canon's laser printer sales in 2012. HP's shift to page-wide-array ink jet will significantly affect Canon's laser printer business, both in hardware and supplies.

Conversely, HP and Canon are rivals in the ink jet market and are the top two ink jet vendors. Epson is the only other major competitor in the desktop ink jet printer market at this time. Although HP still leads the market, its sales have been declining. Canon's unit shipments have been rising, albeit very slightly, over the past two years. As shown in **Figure 24**, both companies are experiencing declines in revenue, although Canon is doing slightly better than HP.

**Figure 24: HP and Canon Revenue for Ink Jet Segments, First-Quarter 2008 to First-Quarter 2013**



Source: Photizo Group and HP and Canon annual reports

HP is putting a concerted effort into the Officejet Pro X line and, if the current offerings are successful, it will likely expand its page-wide-array ink jet offerings. But it will also continue to offer laser printers well into the future. Page-wide-array ink jet may have strong growth opportunities, but it will not overtake laser technology for many years, if ever.

Canon may lose some laser printer sales to page-wide-array ink jet devices, but laser printer sales will still account for the largest portion of its office printing revenue and still represent a strong revenue opportunity. However, Canon may need to increase its research and development to make laser devices more competitive with page-wide-array ink jet machines by improving price/performance and supplies costs.



## Our View

Page-wide-array ink jet technology has been viewed as a potentially transformative technology in the printer market because of its higher speed, lower cost of ownership, and low energy consumption. These are the reasons why Silverbrook raised a stir in 2007 when it demonstrated its first Memjet printer. There was considerable interest in the technology but little activity because Memjet was one small voice crying out in the wilderness. Now entering the market is HP, the loudest voice in the forest.

The desktop laser market is relatively stagnant—little change has taken place in the market over the past few years. Both monochrome and color laser printer development has slowed, largely because there is little room for improvement. Print quality is about as good as it will ever be, low-end printers are already selling below cost, hardware prices cannot go any lower, and the cost of supplies—the segment in which most vendors hope to make a profit—is too high and may be limiting print volume. Minor, incremental improvements have been made to print speeds, and there is little incentive for major R&D spending outlays. Most vendors are putting more effort into higher-end shared devices that can operate as the on- and off-ramp to corporate digital workflow initiatives.

For HP, the Officejet Pro X brings new opportunities. It is clearly faster than any comparably priced laser printers on the market, with lower printing costs and a more ecological footprint. It has minimal supplies that need to be discarded and features lower power consumption than its laser competitors.

Since this is HP's own technology and it will likely be more profitable for the company than its low-end laser printers—which are in a highly competitive market where printers are routinely sold below cost and supply sales are small as a result of low usage rates—the company will likely launch a strong marketing campaign for the Officejet Pro X. This will be a concern for its LaserJet division and Canon, HP's LaserJet marketing partner. Because HP is the dominant player in the market, IT managers will be more willing to consider the Officejet Pro X, especially since most of the printers that their businesses already own are likely HP laser devices.

All of HP's laser competitors clearly need to come up with a response to this product and look for whatever chinks there may be in the armor. At the same time, they need to find a way to compete with the device. Memjet's response will likely be “thanks, HP,” for helping to validate page-wide-array ink jet technology and providing the company with a lot of potential customers, although Memjet will still face the formidable task of competing with HP's products and brand.

Will these page-wide-array ink jet devices succeed in breaking the laser bias found in office environments? From a technical and feature standpoint, the answer is yes. From a market standpoint, however, the answer is maybe. Much of it depends upon the messaging and staying power of both HP and Memjet in this technology segment. HP can always return to a stronger emphasis on laser printers, even if the company's relationship with Canon limits how much money it can make or restricts how much control it has over product design. Memjet may have some niches, such as wide format or other industrial market opportunities, but office environments seem to offer the best opportunity for sustained growth. Both companies appear to be in the fight for the long haul, but management imperatives do change, and there are few rapid changes in the market.

The iPad is certainly one example of a product that rapidly changed the market, but the most notable may be the desktop laser printer, which was first introduced in 1984 and virtually obliterated the daisy-wheel printer market in less than five years. Daisy-wheel printers had markedly better letter-quality output compared to laser printers, which were deemed to have only “near-letter quality,” but laser printers were much faster and quieter. It may be that page-wide-array ink jet devices will replace laser machines because page-wide array is both faster and cheaper at competitive price points.

Although laser printer vendors may initially try to dismiss page-wide-array ink jet printers by citing the traditional arguments regarding print-quality and waterfastness—arguments that are more fiction than fact—they will need to find better ways to compete with the threat that these devices pose by improving price/performance and supplies cost or finding a way to join the parade.

## About the Author



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Larry Jamieson leads Photizo's *Hardware Advisory Service*. He has more than 30 years of experience in the information processing industry. Previously, Jamieson was responsible for ink jet and laser desktop printer and MFP analysis, forecasting, and client support at Lyra Research. Prior to 1995, Jamieson was associate director of the Electronic Printer Service at BIS Strategic Decisions.

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